THE HEUGEL QUILL: A NEW TACTILE DEVELOPMENT FOR THE BLIND

by

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Summary. A new tactile writing and drawing device called the Heugel Quill has been developed. It offers the first really effective apparatus for the blind to easily write or draw, with an immediate tactile evaluation of the raised line created by the act of writing or drawing.

Genesis of the Idea

Several years ago, from experience with blind college students in mathematics classes, it became obvious that many blind students have talent that remains dormant, simply because no effective means exists to early recognize and then develop that talent. In most classes, in almost every subject and almost every level, some explanation is given which is supported by a representation that is graphical, geometric, or in some fashion spatially and visually presented. The blind student becomes very dependent upon word descriptions. Often these are severely inadequate, for even if the student offers proper words in response, the evaluation of his mentally held image is still far away. It was obvious that there is needed a more effective means of communicating images and ideas which are generally presented visually. We, the blind students and myself, were led to explore the current state of technology for the blind, seeking a simple and effective means to convey, each to the other, visual images so that effective evaluation might occur. Thus, we sought tactile representation of drawings which are typically visually examined.

We were disappointed at the state of the art. We sought a means whereby anything which would be normally drawn on a chalkboard might also be easily and quickly presented the blind student, in raised line form, for his evaluation. More importantly perhaps, we desired an instrument which offered the student capability of drawing or writing, with raised lines resulting so that the student might be a participant, particularly in the sense of presenting his own mental imagery for inspection and evaluation. We evaluated those tools which were advertised as drawing or writing kits, being informed that there did exist already effective raised line drawing apparatus. We were dismayed at the sorts of devices available. Two such devices are described in the Seventeenth Edition (July 1971-June 1972) of Aids and Appliances, a publication of The American Foundation for the Blind:

> Raised Line Drawing Kit: A method whereby blind people may draw or write and feel the lines on the top surface as the lines are made. The kit comprises a rubber covered drawing board with holddown clips for 8½" x 11" material, a ballpoint pen filled with a colorless lubricant, and a package of polyester film sheets which serve as the "paper."
>
> Heretofore, it has been necessary to turn the page over to feel the lines made with tracing wheels and the like, but with this new development, the lines can be felt on the top side of the page. The lines so made are quite easily followed by sight.
>
> Script Guide: This writing guide . . . is used as the basis for a course in longhand writing which is enabling many who have never learned to write ordinary script to master this skill with minimum of effort. It is composed of a clip board which takes standard 8½" x 11" paper. Down the left edge of the board is a notched guide on which a carriage with a clicking device carries a 3/4" slot, formed of two thin metal rods. The far end of the slot is fitted into a metal block, and another such block slides on the rods to serve as margin stop. The carriage rotates on the notched guide so that it can be raised to simplify insertion of the paper.

Additionally, sheets of tin foil were used by some, drawing on one side with a fairly sharp object, so that a raised line appeared on the other side. This, of course, causes a student who is already with some difficulty, to draw a mirror image of what he actually desires, so that the desired image is presented on the other side in raised line form.

Two conclusions followed quickly. First, if those sorts of devices presented the best available, then it is no wonder that so much mental development of the blind never occurs. Anyone who has attempted to use the raised line drawing kit understands well its awkward limitations. We were to learn later, in visiting schools and centers for the blind, that such drawing and writing kits are often lost, having been discarded by the teachers as an ineffective tool. Next, we decided to seek federal funding.

Seeking of Federal Assistance

The lack of effective drawing and writing equipment for the blind was thoroughly investigated. We inquired of the Texas Commission for the Blind and, among others, the Arkansas Enterprises for the Blind. Finally, in July 1971 we attended the national meeting of the American Association of Workers for the Blind in Richmond, Virginia, seeking out those who were most knowledgeable about the technology available to the blind. Being convinced that nothing about offered the capability we desired, we sought interviews with officials of HEW, particularly the Office of Research and Develpmnet, Bureau of Education for the Handicapped. We presented descriptions to them of two devices for which developmental funds would be requested,

From: Proceedings 1972 Carnahan Conference on Electronic Prosthetics, John S. Jackson and R. William DeVore, eds, Carnahan House, U. of Kentucky, Lexington, Dec 1972.

if there were interest on their part. One of the devices described then amounted to a board, to be placed before the student, so that anyone, sighted or blind, might write or draw on it with an immediate raised line appearing in the path of the stylus. It would offer the feature of deforming paper or plastic, so that the student would have "carry-away" record of that which transpired, as a sighted student might sketch drawings from the chalkboard for his later examination. Initial response to the proposed project amounted to "it can't be done." However, we were about the moon effort, so we pursued that point, only to learn that "If it can be done, it will not be done in Texas or at the University of Houston. It will be done at MIT or Stanford ---where the good people are---where they do sophisticated things." (MIT has a Sensory Aids Development Laboratory and Stanford offered recent development of the Optacon.) Later, there was submitted a proposal to HEW, requesting developmental funds for the desired sophisticated drawing and writing device, but the proposal was negatively received and not funded.

Richmond Instruments

After much early design effort, the problem of actually constructing the device desired was placed before Robert Heugel of Richmond Instruments, in Richmond, Texas. Heugel had past success in building equipment for the Apollo 16 mission (to evaluate eye fatigue) as well as having designed and built equipment for purposes of eye surgery at the Medical Center in Houston. Resulting was a very sophisticated piece of equipment, now called the Heugel Quill, which allows sighted and blind alike to draw with a stylus, on paper, with there resulting immediately behind the stylus, a raised line. Construction time for that apparatus, which was too sophisticated to be built in Texas, was barely more than three months.

Demonstration and Application

With the prototype available, demonstration was made of the Heugel Quill at the Criss Cole Rehabilitation Center for the Blind (Austin, Texas), the Lighthouse for the Blind (Houston, Texas), the Arkansas Enterprises for the Blind (Little Rock, Arkansas), and most recently at the sectional meeting of the American Association of Workers for the Blind (San Antonio, Texas). From these demonstrations, some in actual teaching circumstances, it has become clear that the potential of the Heugel Quill exceeds that which was earlier anticipated. For those who need to learn handwriting skills, the Heugel Quill offers real means to allow the student to evaluate his own effort. A college age girl at Criss Cole Center, upon using the Heugel Quill, was for the first time in her life, able to evaluate that which she had written in script. She was mortified, exclaiming, "Oh, I hope I don't always write my name so poorly!" Much benefit will arise in teaching mobility skills. From the viewpoint of the instructor, much time will now be preserved since preparation of much material in raised line form can be accomplished with the Heugel Quill. An entire new mental process can be required of the student. After examining mock-ups of areas (made of plyboard or plastic) he can now be asked to roughly draw a map indicating the path he will take. His explanation now will be done with more than words, thereby allowing more effective evaluation. Quickly drawn maps are now thus available, showing obstruction which may have occurred overnight (such as street construction, campus construction) causing new routes to be used. Now house plans can be sketched easily in raised line form, allowing the blind to participate more in planning a house, choosing an apartment, or even becoming acquainted with the lay-out of a new neighborhood or a grocery store. Development of spatial concepts is radically enhanced. Now the procedure, in some instances, is to stack many plastic or wood circles, triangles, squares, etc. of differing sizes before the student. He then identifies them, separating all common shapes into individual stacks. However, more than identification is needed and the Heugel Quill offers capability in that direction. The student can now be asked to explain his own concept by being allowed to draw it, evaluate it for himself, then offering the instructor the representation which the student testifies, by tactile sense, is his image of the concept. More communication is possible. A tactile laboratory setting is one modification, allowing Heugel Quills to all be activated by the drawing on anyone of them, that choice being made by the instructor. Now students sit dormant in many classes while the teacher works in a one-on-one situation.

Many applications are possible. A sighted student will see a sketch of a nerve ending on a chalkboard of a biology class. This now can be quickly offered a blind student on a Heugel Quill, instead of searching for something such as a frayed telephone cable for his examination. Graphs in business courses, education courses, or psychology courses are immediately his on the Heugel Quill. He can even feel graphs of mathematical functions as they are being drawn, evaluating them immediately, raising questions, if any, at the appropriate time.

Description of the Heugel Quill

The Heugel Quill is a rectangular box, without a top, which has a perimeter lid. The lid, with one lever, clamps the paper into place, drawing the paper taut, stretching it with the clamping mechanism away from the center of the page. Above the page is a stylus, with a flat circular foot that, upon being placed to the surface of the paper, offers a small channel into which a reciprocating pin hammers from below the surface of the paper. The stylus and the motor driven reciprocating foot (9000 RPM) are constantly in mirror image to each other, upon the stylus being placed to the paper. An arm arrangement connects the two, running from the stylus above the paper, to the back of the rectangular frame, down, and then under the paper to the motor driven pin. The motor driven pin rests on a ball bearing apparatus that rests on a mechanism which offers movement in both x and y components and thus, in any direction at all. Figure 1 following shows the unloaded Heugel Quill, with lid down. Figure 2 shows a similar view with the horizontal bar in relaxed position, allowing the user access to the dial which raises and lowers the height of the pin. Figure 3 shows an end view with the lid open. Figure 4 shows the Heugel Quill in operation.

Research Proposed

Much research, which has been needed for a long time, now is with an effective mechanical means with which that research can be performed. For instance, what is the most advantageous height and width for a raised line for six year old children to read tactilely? What is it for twenty year olds? Is it different for different age groups? What is it for the mentally retarded? What is it

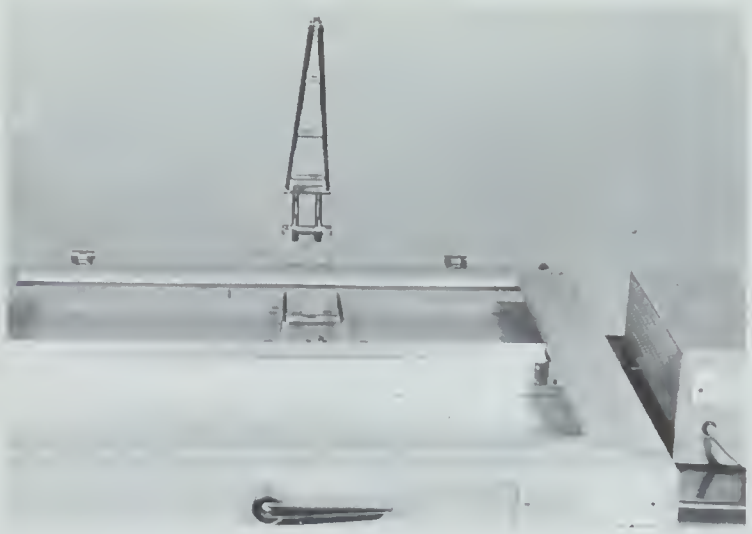

FIGURE 1. The Heugel Quill, unloaded, with the lid down.

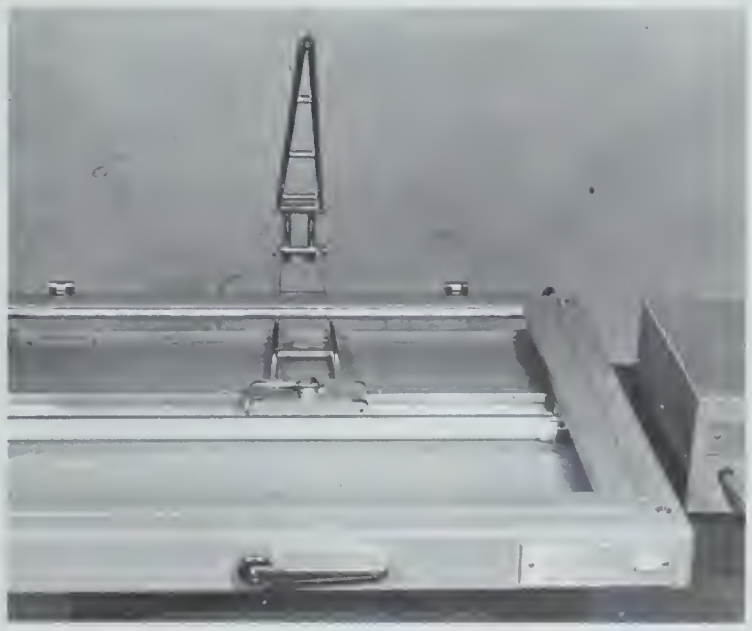

FIGURE 2. Horizontal bar in the relaxed position allowing the user access to the dial which raises and lowers the pin.

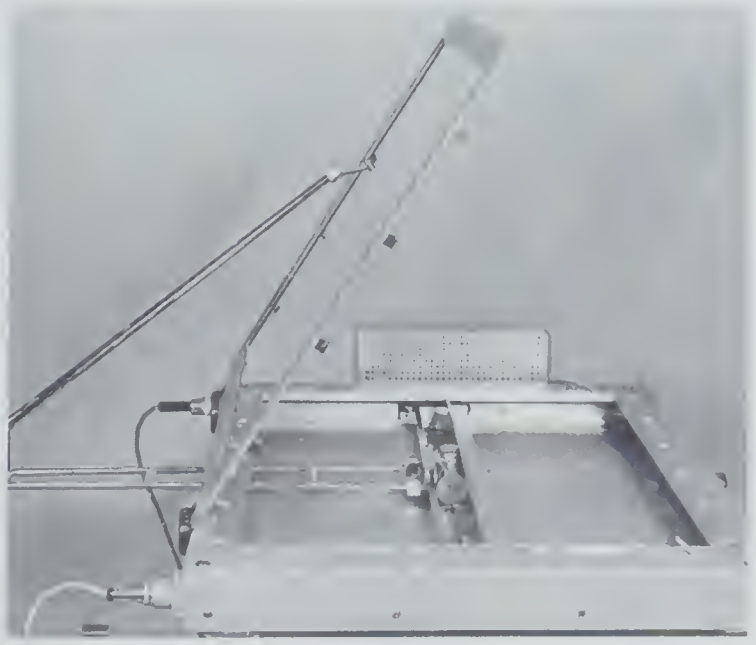

FIGURE 3. End view of the Heugel Quill with the lid open.

FIGURE 4. The Heugel Quill in operation.

for those who are diabetic and have reduced tactile senses? With the Heugel Quill the foot of the stylus and height of the reciprocating pin can be adjusted so as to alter the deformation of the paper. Such questions as those above become possible to answer.

What spatial concepts now go untaught or poorly taught because of the essential dependence on a method which is primarily one of inspection? How, using the Huegel Quill, may these be more effectively taught? As an example, the teaching of the concept of a diagonal is described in [3]. It is a complicated and difficult procedure which is indicated. Does the Heugel Quill allow access more easily to the development of that concept and what is the technique? What are the implications of the Heugel Quill for mobility training? What spatial concepts, if better developed, simplify mobility skill development? How is the Heugel Quill to be most effectively used as a mobility instrument?

Many similar questions may now be approached, making more effective the training, teaching, and even employment of the blind. While other recent technological developments, such as the Optacon [1], the Cognodictor [2] or Visotactor [2] are of effective, but restricted use, the Heugel Quill offers advantage to the full population of the blind.

Bibliography

1. OPTACON NEWSLETTER, Stanford University, Stanford, California, Issue No. 1, November 1970.

2. Smith, Glendon C. and Mauch, Hans A., Abstract of Summary Report on the Development of a Reading Machine for the Blind. Bulletin of Prosthetics Research, Department of Medicine and Surgery, Veterans Administration, Washington, D. C., Fall 1971, pp. 177-178.

3. Wheeler, Jane, Teaching the Concept of the Diagonal During Handwriting Lessons for the Congenitally Blind. New Outlook for the Blind, v. 64 (1970) 249-255.